see similar formations of light to those which occur during my experiments with kathode rays around a magnetic terrella.

In my work, "The Norwegian Aurora Polaris Expedition, 1902–1903," descriptions will be found in several places of these phenomena, but to elucidate the subject here I append a few new illustrations, which show very plainly the shape of these formations of light.

Figs. 1 and 2 show how the rays are drawn in in belts around the magnetic poles of the terrella, corresponding with the polar-light zones on the earth. They are taken looking along and perpendicular to the magnetic axis. Fig. 1 shows the spiral rings of light around a magnetic north pole, corresponding to the south pole of earth magnetism. We find these belts of light sometimes, as here, with a tolerably even strength of light like a continuous band, and at other times we find the rays concentrated in three limited streaks, with well defined positions around the magnetic poles of the terrella.

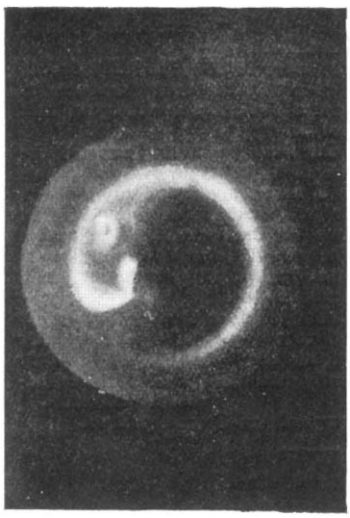

FIG. 1.

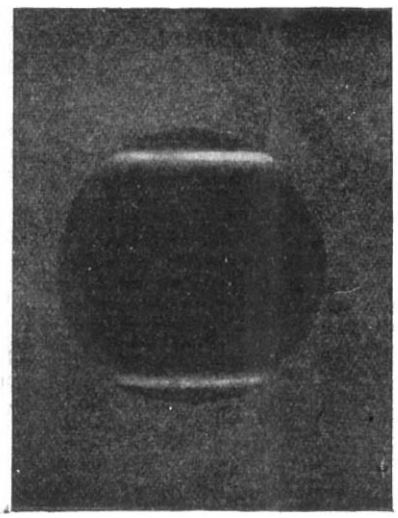

FIG. 2.

FIG. 3.

Fig. 3 also shows an equatorial ring. This phenomenon of light is magnificent, but unstable; it is difficult to produce; it may suddenly appear and suddenly vanish, as the rays which run round the terrella at the equator are difficult to obtain sufficiently concentrated for the rarefied gas to illuminate them. At the lower part of Fig. 3 and on Fig. 4 a characteristic pointed tongue of light will be seen, which is drawn in, and shows the manner in which the rays here come into the terrella. The magnetic equator is indicated on the terrella by a dark line.

FIG. 4.

It may now be imagined that analogous formations of light may be observable around the earth of the rays from the comet's tail on May 18–19. The downward rays in the Polar regions will, it is true, be difficult to observe in northern parts owing to the northern declination of the sun, but in Antarctic regions there may be more hope of doing so, and the phenomenon would then probably appear somewhat similar to the aurora australis. At night, in low latitudes, one may conceive the possibility of a ring like the equatorial ring being observable.

About May 2 the comet will be in the vicinity of Venus (see *Bulletin de la Société astronomique de France*, February, p. 57), and it is not impossible that indications of an alteration in those parts of the comet's tail nearest the planet may be noticeable.

We may then possibly expect to find traces of the rays being drawn in towards the polar regions of Venus in a manner similar to that demonstrated by the experiment shown in Fig. 4, or a more or less distinct bending of the comet's tail, assuming Venus to be magnetic.

The probability of such being visible must, however, be admitted to be small, as the central line or the tail, if it is directly away from the sun, will be at a considerable height above the planet; but I desire, nevertheless, to direct the attention of astronomers to these conditions, as Venus, if as strongly magnetised as our earth, must be expected to exercise a noticeable influence on the tail of the comet at a distance of several million kilometres, especially if the rays in the tail are easily deviated by magnetic force.

This phenomenon may, in case it is present, be determined by astronomical observations of the comet's tail and Venus in the period May 1–3, and I beg, therefore, to ask astronomers, in the interests of science, to make arrangements for the necessary observations, if possible, and to favour me with a short account of the results.

KR. BIRKELAND.

Universitetets Fysiske Institut, Christiania, March.

Neutral Doublets at Atmospheric Pressure.

IN his papers on magneto-kathode rays, Prof. Righi assumes the presence of neutral doublets, formed of a positive and negative ion in more or less stable combination. Sir J. J. Thomson has independently put these in evidence very clearly in his experiments on positive rays. Working independently, we have made some observations which point to the existence of such doublets at atmospheric pressure. Ionised gas is drawn through two insulated metal tubes; along the axis of each a thick insulated wire electrode is fixed. These wires can be connected in turn to a Dolezalek electrometer, and the current between tube and electrode measured. The ionised gas is produced by splashing mercury, or by heating lime or aluminium phosphate on a strip of platinum foil. With a certain blast, in one case, the current reached its saturation value on the first electrode with a voltage of 320, being then 130 in arbitrary units. Raising the voltage to 656 did not increase this by one division; the extreme readings at the intermediate voltages were 128 and 130, so that the observations were quite regular. Nevertheless, with 656 volts on the first electrode a current can be detected at the second, this in some cases amounting to as much as 10 per cent. of the original.

Lime gives a large excess of negative, mercury and aluminium phosphate of positive, ions, but in each case

tried the currents on the back electrode were practically the same, independently of the sign, while the same ionising agent was used. The saturation curves also present a peculiarity in a large number of cases. The curves become nearly horizontal at about 240 volts, after which they rise again rather rapidly, and finally become flat at about 320 volts. Each of these results is readily explained if we assume the presence of neutral doublets, which are broken up either by collisions or by the action of the field. Further experiments are being made.

A. E. GARRETT.
J. J. LONSDALE.

Cass Institute, E.C., April 13.

The Etiology of Leprosy.

IN NATURE of April 7 I have read with interest the article on Dr. Ashburton Thompson's report on "Leprosy in New South Wales." In that report Dr. Thompson (one of our foremost authorities) has repeated a statement made in several of his former papers avowing distrust in the doctrine of contagion and in the efficacy of isolation as a preventive measure. In commenting, with surprise, on his opinion, that writer of the article says:—"One would have thought that the success which has attended the practice of isolation in Norway during the past forty years afforded sufficient evidence of its value even to the most sceptical."

Now I am quite with Dr. Thompson in his opinion, and must ask to be allowed to state in the clearest possible terms that not only is there no reason to believe that attempts at isolation have taken any share whatever in the diminution of Norwegian leprosy, but much to the contrary. That the disease has declined, and continues to decline, is happily true. The *propter hoc*, however, fails utterly when we recognise that there has been during this period of its decline no increase whatever in isolation. There has never been in Norway any isolation directed against contagion. The first large leper hospitals in Norway were built by those who did not believe the disease contagious (Dr. Danielsen and others), and who wished simply to prevent marriages and to provide comfortable homes. When the bacillus was discovered, the old theory of contagion was revived, and subsequently certain legal enactments were passed, but there was no increase in arrangements for isolation. Quite the contrary. From that day to this the number of those isolated has been progressively reduced. The lepers have been left at home with their relatives. Yet the disease has declined. It may be noted that it was declining before. It must be obvious that it has been dying out under some other influence, and that the asylums, which no one had thought it worth while to provide, could not possibly be the cause. Let me in passing just remark that during the same period a parallel effort for the extirpation of leprosy was being made in South Africa. There efficient isolation laws were passed, and plenty of accommodation provided. Without flinching, compulsory isolation was carried out. The result has shown a steady and alarming increase in the disease.

Compulsory isolation has never been attempted in Norway, and it has been rigidly enforced in South Africa. The results have been conspicuously opposite to what believers in contagion would expect. The true explanation in each case is, I believe, not difficult to give, but I must not intrude upon your space further than simply to assert that it has nothing to do with belief in contagion and attempts at isolation. Dr. Thompson is, I think, more than justified in the doubts which he has expressed, and it rests with those who in future quote the Norwegian facts to show that they really bear the interpretation which they give to them.

JONATHAN HUTCHINSON.

SIR JONATHAN HUTCHINSON'S views on the etiology of leprosy are well known to be opposed to the generally accepted view that it is an infectious disease caused by Hansen's bacillus. They were again brought before the second International Conference at Bergen, August 16–19, 1909. Nevertheless, the conclusions carried by the delegates were opposed to them. The second International Scientific Conference for the suppression of the disease reaffirmed in all aspects the conclusions adopted by the first conference in Berlin, 1897, when the attitude of Dr. Ashburton Thompson towards the accepted etiology was before the delegates. Leprosy was affirmed to be a disease communicable from one person to another. No country, no matter what its geographical situation may be, is secure against infection, and the adoption of proper measures against this possibility was recommended:—"Having regard to the favourable results which have been obtained in Germany, Iceland, Norway, and Sweden, by isolating the patients, it is desirable that infected countries should adopt the same measures."

In Norway the law, as formulated again in 1885, gave the Sanitary Commission or Board of Health in each district the right to order a leper, if he will live at home, to have his own room—at least his own bed; his clothes ought to be washed separately; to have his own eating apparatus—spoon, fork, knife, &c. If he cannot, or will not, conform to this regimen, he is obliged to enter an asylum. There are those who hold that leprosy is less easily communicated from the sick than is consumption. Dr. Thompson apparently implies that "special precautions therefore seem to be unnecessary" in leprosy because in the past they have been ignored for tuberculosis; but, in the opinion of the writer, it would be of enormous advantage to the public weal if the regulations as applying only to lepers remaining at home could be enforced in regard to tuberculosis. As a matter of fact, the success of the leprosy laws in Norway has led, on the initiative of Dr. Claus Hansen, brother of the discoverer of the *Bacillus leprae*, to the enforcement of analogous regulations as prophylactic measures against tuberculosis in that country since 1900.

It alters nothing in the efficacy of segregation that it was applied in Norway by Danielsen before Hansen—Danielsen's pupil, I believe—had discovered the lepra bacillus. Nor will any useful purpose be served by discussing the efficacy in the application of the law of segregation in Norway as impugned by Sir Jonathan Hutchinson. Dr. Ashburton Thompson's criticisms had been carefully studied by the writer of the article and passed in silence as special pleading—moderate, able, even eloquent—but as unconvincing to him as they have been to the expert delegates at two successive international conferences, the second of which was held in Norway itself.

THE WRITER OF THE ARTICLE.

Auror l Display.

THERE was a very fine display here of the aurora between 8 and 9 p.m. The nature of the phenomenon was sufficiently clearly marked to deserve more than a passing notice.

The curtains and shafts of light all had their origin overhead, radiating from a point a few degrees to the north of Castor and Pollux. At times as many as five curtains of light could be seen close together near the radiant centre, some of them spreading over the southern and others over the northern sky. When viewed to the north or south the thin veils showed streaks of light all radiating from the point of origin overhead. When viewed towards the east or west, *i.e.* end on, the light was most brilliant, and the wavy nature of the hanging curtains of light most marked.

For at least an hour these curtains or hanging veils of light could be seen originating above and spreading in all directions, north, south, east, and west. The radiating effect was, of course, due to perspective. There was very little wind at the time, and the curtains of light seemed to travel with it. Another effect which was most marked was that the east and west end of a curtain descending to the north of the point of view curved towards the north, whilst the ends of those curtains which descended to the south of the point of view of the observer curved to the south. This curving only showed itself when the curtains were low down and losing their brilliancy. There could be no doubt but that the whole phenomena originated in a comparatively small area to the north of Castor and Pollux.

The day had been fine and bright, and the ground was free from snow. Towards half-past nine the sky became hazy.

R. M. DEELEY.

North Battleford, Saskatchewan, Canada,
March 28.